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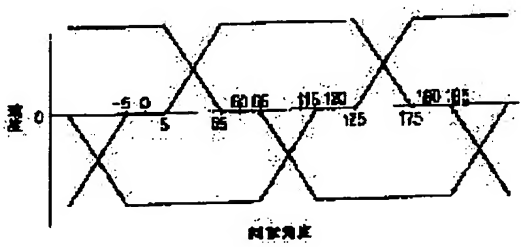
(72)Inventor : IKUNOBU TAKESHI

(54) MULTI-CONNECTION TYPE NON-PULSATION FIXED QUANTITY PUMP

(57)Abstract:
PURPOSE: To remove pulsation by preventing the opening/closing of suction/ discharge valves from being delayed, in the case of a multi-connection type reciprocation pump (plunger, diaphragm, bellows or the like) in which plunger or the like speed is controlled so that the sum of flow discharged from each pump may become fixed at all times.
CONSTITUTION: A section in which a plunger or the like is stopped within a fixed range and discharge or suction is not conducted at all at the time of each pump entering into a discharge stroke from a suction stroke and entering into a suction stroke from a discharge stroke, is provided.



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[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Multiple-string type the non-rippled metering pump characterized by having the section which stops in the range with a fixed plunger etc. in case it goes into an inhalation process from regurgitation distance in case each pump goes into regurgitation distance from a charging stroke in the multiple-string mosquito formula reciprocating pump by which speed, such as a plunger, is controlled so that the sum of the flow rate breathed out from each pump becomes always fixed, and does not perform the regurgitation or inhalation at all.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to multiple-string type a non-rippled metering pump.
[0002]
[Description of the Prior Art] The multiple-string formula reciprocating pump by which speed, such as a plunger, is controlled so that the sum of the flow rate breathed out from each pump always becomes fixed is known. If it is closed at the delivery of this pump and a valve is prepared, a pressure will be stood compulsorily, a pressure gage will be formed between a tightness valve and a delivery, if it explains taking the case of the case of 3 run type plunger pump used as a thing as a velocity curve indicated to be to drawing 5 , and the change is recorded on chart paper, it will become like drawing 6 . That is, six throb occurs in pump 1 rotation. If this is contrasted with angle of rotation of a cam, it will become like drawing 7 . It is [0003] when the plunger of 3 runs is set to A, B, and C.

プランジャー	吐出開始	吐出終了
A	0°	180°
B	120°	300°
C	240°	60°

It becomes. That is, throb occurs at the time of the regurgitation start of each plunger, and an inhalation start. This is produced in order that the timing which a pumping valve opens and closes may be overdue compared with the movement of a plunger. It is as follows when this is described in detail according to drawing 8 .
[0004] ** Drawing 8 (a) shows the state of the valve at the time of the regurgitation, the discharge valve (Vd) opened it, and the suction valve portion (Vi) has closed it. ** Drawing 8 (b) shows the state of the valve at the time of a regurgitation end, opened the discharge valve (Vd) a little, and has closed the suction valve portion (Vi). ** The state at the time of an inhalation start is shown in drawing 8 (c), and completely, a discharge valve (Vd) is not closed but is opening the suction valve portion (Vi) a little. ** The state at the time of inhalation is shown in drawing 8 (d), and a discharge valve (Vd) closes and is opening the suction valve portion (Vi). ** The state at the time of an inhalation end is shown in drawing 8 (e), and a discharge valve (Vd) closes and is opening the suction valve portion (Vi) a little. ** The state at the time of a regurgitation start is shown in drawing 8 (f), and a discharge valve (Vd) is opened a little and has not closed a suction valve portion (Vi) completely.
[0005] The state of ** and ** causes pulsation by above distance ** - **. That is, in the distance (drawing 8 (c)) of **, since the discharge valve (Vd) has been completely closed in spite of the time of an inhalation start, an adverse current takes place from the outside of a discharge valve (Vd), the flow rate of the whole pump falls off momentarily, and a pressure falls. Moreover, in the distance (drawing 8 (f)) of **, the liquid in a pump will be extruded momentarily on the outside of a suction valve portion (Vi), and, also in this, the whole flow rate will fall off.
[0006]

[Problem(s) to be Solved by the Invention] Throb was completely uncancelable, although various works were carried out, since he did not understand generating of such throb completely conventionally.
[0007] Then, it is in the purpose of this invention losing throb, and it becomes a technical problem to make it for that not cause the delay of opening and closing of a valve.
[0008]
[Means for Solving the Problem] It is characterized by having the section which stops in the range with a fixed plunger etc. in case it goes into an inhalation process from regurgitation distance in case each pump goes into regurgitation distance from a charging stroke in the multiple-string formula reciprocating pump by which speed, such as a plunger, is controlled so that the sum of the flow rate by which this invention is breathed out from each pump becomes always fixed, and does not perform the regurgitation or inhalation at all.
[0009]
[Function] The mechanism it is made not to cause the delay of opening and closing of a valve by this invention makes a plunger stand it still during a fixed period which exists completely at the time of the distance of the above-mentioned ** and **. ** from -- when the distance to ** is considered and a plunger stands it still in the ** state in a top dead center, since the suction valve portion has closed, the whole flow rate does not fall Moreover, natural fall is carried out by the self-weight of **** in a pump on the outside of a discharge valve for this pressure. For this reason, while a plunger stands it still, both pumping valves will be in the state where it has closed completely. Next, when it goes into the state of **, since the discharge valve is closed completely, it goes into a charging stroke (**), without liquid flowing backwards.
[0010] Next, if a plunger is made to stand it still in the state of ** in a bottom dead point when the distance from ** to ** is considered, it will be in the state where the rate of flow in a pump also became zero, **** of a suction valve portion carried out natural fall by the self-weight, and both pumping valves have closed it completely. ** a case -- a discharge valve -- having closed -- a state -- it is -- since -- a pump -- don't affect it to the total discharge quantity Next, since the suction valve portion is completely closed when it goes into the state of **, all the liquids in a pump are extruded out of a discharge valve. Namely, not through ** (drawing 7 (f)), it will be in the state of drawing 7 (g) from ** (drawing 7 (e)).
[0011]
[Example] If an example of the velocity curve of the plunger which carries out movement which was described above is shown, it will become like drawing 1 . ****** [a theory top] for what times as long as there is time for **** to close completely although this is an example for which the plunger between 10 degrees stands it still in the angle of rotation of a cam by the case of a cam action. Moreover, in order to gather the speed which **** closes, you may push **** by the spring. the velocity curve to which the plunger is moving -- what form -- be -- the compound thing -- always -- fixed -- ****ing . Moreover, the number of runs is also good without limit at two or more. However, if it actually manufactures, when economic efficiency will be considered, at least 5 run type is a limit. Moreover, considering a performance, by 2 run type, since a charging stroke becomes short from regurgitation distance, the shortage of inhalation tends to take place and a charging stroke is intermittent, problems -- a flowmeter is not attached by the inlet side -- come out. Therefore, 3 run type is the best.
[0012] If this invention is a reciprocation method, it can carry out not only an above-mentioned plunger pump but a diaphragm pump, and a bellows pump and a piston pump. Moreover, to one plunger, the gestalt of the cam action of a pump arranges three plungers to a radial, it can drive by one cam, or although one cam (common cam) is a standard (drawing 2 (a)), can process a cam into (drawing 2 (b)) and a cam plate, and can also usually make it an axial type (drawing 2 (c)).
[0013] The concrete composition at the time of applying to an axial type at drawing 3 is illustrated. As shown in drawing 3 , three plungers (2) are predetermined phases, and it holds in housing (1) possible [sliding of shaft orientations]. Each plunger (2) consists of a narrow diameter portion (2a) where a nose of cam advances into a pressurized room (3) at the time of the rightward regurgitation stroke of drawing, and the major-diameter section (2b) which supported the shot (4) to the back end, and is supported by bearing (5 6), respectively. The shot (4) supported by the plunger (2) is engaging with the cam groove

(8a) of the cam board (8) fixed to the axis of rotation (7). Although not shown in a drawing, the engagement relation between a shot (4) and a cam groove (8a) is maintained by the usual return mechanism in which a spring, oil pressure, etc. were used. Moreover, the outer diameter and the side of a cam board (8) are guided by the bearing (9 10) fixed to housing (1). In addition, you may omit bearing (9). As shown in drawing 4 (a) and (b), the cam groove (7a) is set up so that the depth (s) to a predetermined angle of rotation (theta) may draw a velocity curve as a plunger (2) indicated to be to drawing 1 . The axis of rotation (7) is supported by housing (1) through bearing (11 12), and is connected with driving means, such as a motor, in the axis end projected out of housing (1). A usual suction valve portion (Vi) and a usual discharge valve (Vd) are attached in the pressurized room (3), and it is formed in the interior of housing (1), without the path for unifying the inhalation to three pressurized rooms (3) and the regurgitation from three pressurized rooms (3) using external piping, when it is an example of illustration.

[0014] This example has the advantage that structure becomes compact compared with the structure of driving three plungers which attached and carried out the parallel arrangement of the three cam boards to the same shaft with the predetermined phase, and moreover assembly and adjustment become easy.

[0015]

[Effect of the Invention] As explained above, in case each pump goes into regurgitation distance from a charging stroke, and in case it goes into an inhalation process from regurgitation distance, it stops in the range with a fixed plunger etc., and since cam type the non-rippled metering pump of this invention has the section which does not perform the regurgitation or inhalation at all, it can prevent the delay of opening and closing of a valve, and can lose throb.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to multiple-string type a non-rippled metering pump.

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PRIOR ART

[Description of the Prior Art] The multiple-string formula reciprocating pump by which speed, such as a plunger, is controlled so that the sum of the flow rate breathed out from each pump always becomes fixed is known. If it is closed at the delivery of this pump and a valve is prepared, a pressure will be stood compulsorily, a pressure gage will be formed between a tightness valve and a delivery, if it explains taking the case of the case of 3 run type plunger pump used as a thing as a velocity curve indicated to be to drawing 5 , and the change is recorded on chart paper, it will become like drawing 6 . That is, six throb occurs in pump 1 rotation. If this is contrasted with angle of rotation of a cam, it will become like drawing 7 . It is [0003] when the plunger of 3 runs is set to A, B, and C.

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[0004] ** Drawing 8 (a) shows the state of the valve at the time of the regurgitation, the discharge valve (Vd) opened it, and the suction valve portion (Vi) has closed it. ** Drawing 8 (b) shows the state of the valve at the time of a regurgitation end, opened the discharge valve (Vd) a little, and has closed the suction valve portion (Vi). ** The state at the time of an inhalation start is shown in drawing 8 (c), and completely, a discharge valve (Vd) is not closed but is opening the suction valve portion (Vi) a little. ** The state at the time of inhalation is shown in drawing 8 (d), and a discharge valve (Vd) closes and is opening the suction valve portion (Vi). ** The state at the time of an inhalation end is shown in drawing 8 (e), and a discharge valve (Vd) closes and is opening the suction valve portion (Vi) a little. ** The state at the time of a regurgitation start is shown in drawing 8 (f), and a discharge valve (Vd) is opened a little and has not closed a suction valve portion (Vi) completely.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, in case each pump goes into regurgitation distance from a charging stroke, and in case it goes into an inhalation process from regurgitation distance, it stops in the range with a fixed plunger etc., and since cam type the non-rippled metering pump of this invention has the section which does not perform the regurgitation or inhalation at all, it can prevent the delay of opening and closing of a valve, and can lose throb.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Pulsation was completely uncancelable, although various works were carried out, since he did not understand generating of such pulsation completely conventionally.
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MEANS

[Means for Solving the Problem] It is characterized by having the section which stops in the range with a fixed plunger etc. in case it goes into an inhalation process from **** distance in case each pump goes into **** distance from a charging stroke in the multiple-string formula reciprocating pump by which speed, such as a plunger, is controlled so that the sum of the flow rate by which this invention is breathed out from each pump becomes always fixed, and does not perform **** or inhalation at all.

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OPERATION

[Function] The mechanism it is made not to cause the delay of opening and closing of a valve by this invention makes a plunger stand it still during a fixed period which exists completely at the time of the distance of the above-mentioned ** and **. ** from -- when the distance to ** is considered and a plunger stands it still in the ** state in a top dead center, since the suction valve portion has closed, the whole flow rate does not fall Moreover, natural fall is carried out by the self-weight of **** in a pump on the outside of a discharge valve for this pressure. For this reason, while a plunger stands it still, both pumping valves will be in the state where it has closed completely. Next, when it goes into the state of **, since the discharge valve is closed completely, it goes into a charging stroke (**), without liquid flowing backwards.
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EXAMPLE

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The velocity diagram for explaining an operation of this invention
[Drawing 2] Schematic drawing showing many gestalten of a cam action
[Drawing 3] Drawing of longitudinal section of the axial nothing throb pump in which the example of this invention is shown
[Drawing 4] The side elevation ((a)) and front view (b) of a cam board which are shown in drawing 3
[Drawing 5] The velocity diagram for explaining the conventional technology
[Drawing 6] The graph which shows the change of a pressure to an angle of rotation
[Drawing 7] The graph which shows the change of a pressure to an angle of rotation
[Drawing 8] Schematic drawing of the plunger pump of each distance
[Description of Notations]
1 Housing
2 Plunger
3 Pressurized Room
4 Shot
7 Axis of Rotation
8 Cam Board
8a Cam groove
Vi Suction valve portion
Vd Discharge valve

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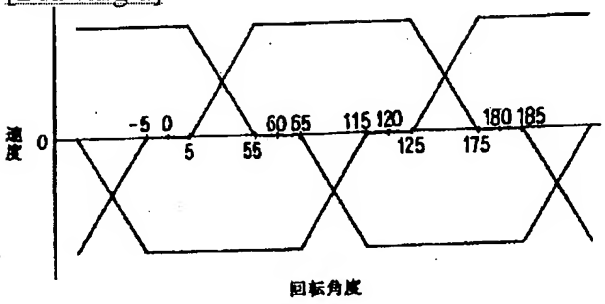
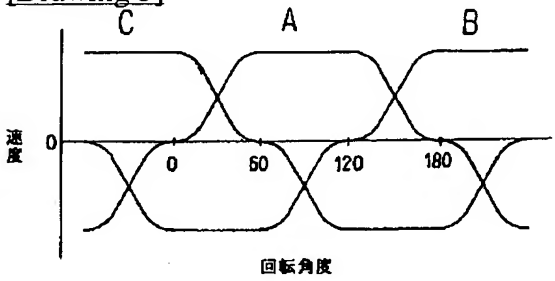
DRAWINGS

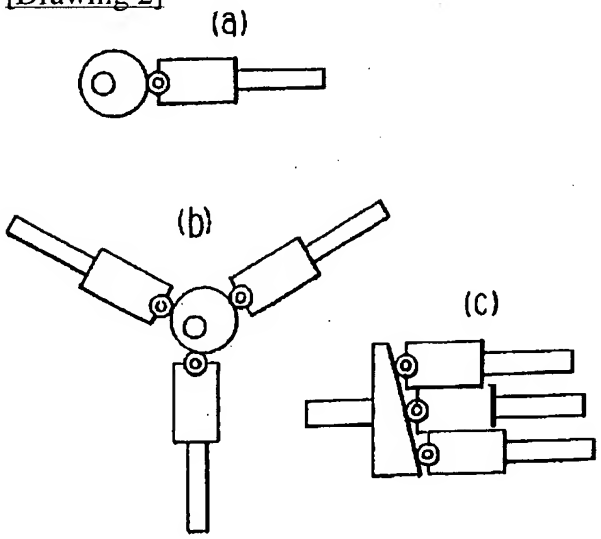
[Drawing 1]



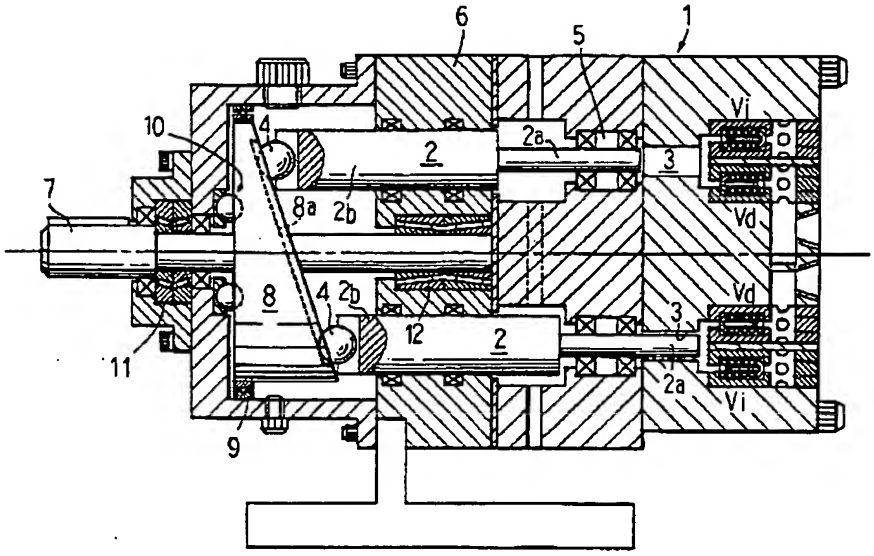
[Drawing 5]



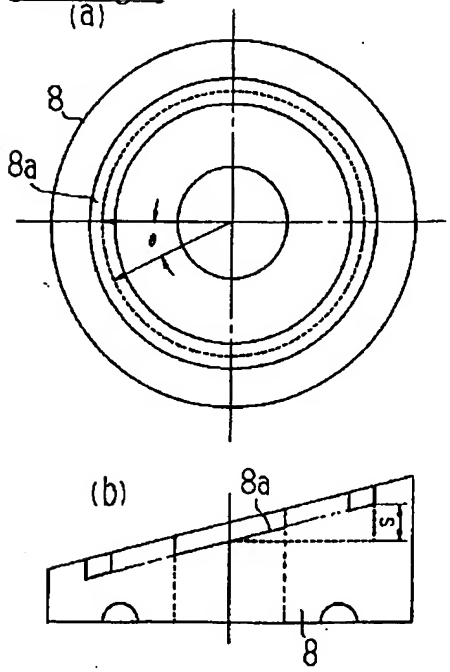
[Drawing 2]



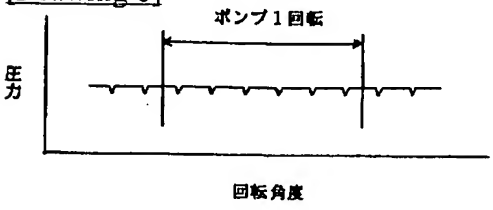
[Drawing 3]



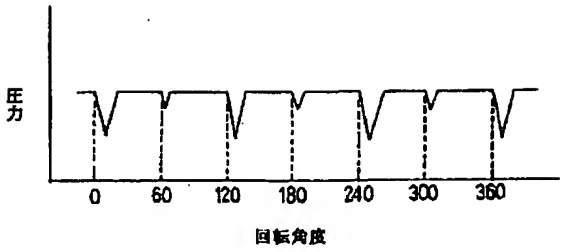
[Drawing 4]



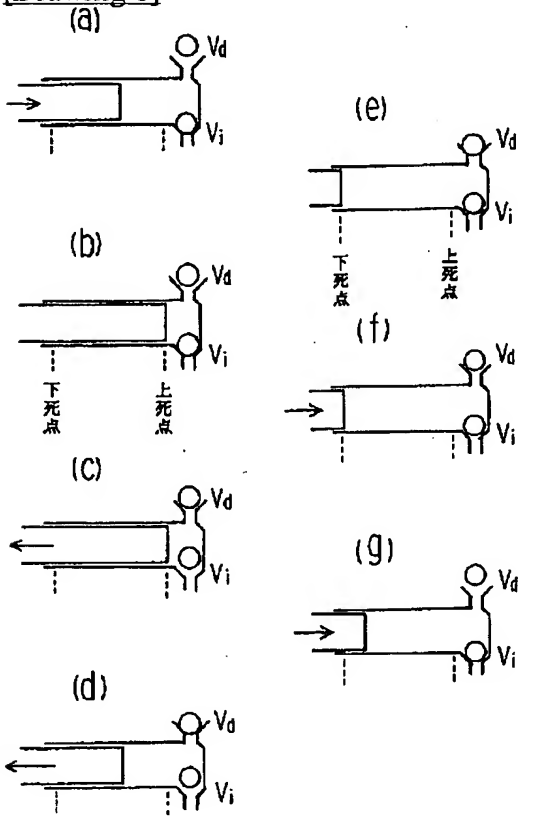
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平6－147102

(43)公開日　平成６年(1994)５月27日

(51)Int.Cl.[5]	識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｆ０４Ｂ　1/20		8311－3H		
11/00		Ｚ　2125－3H		

審査請求　有　　請求項の数１(全　５　頁)

(21)出願番号　特願平4－302030

(22)出願日　平成４年(1992)11月12日

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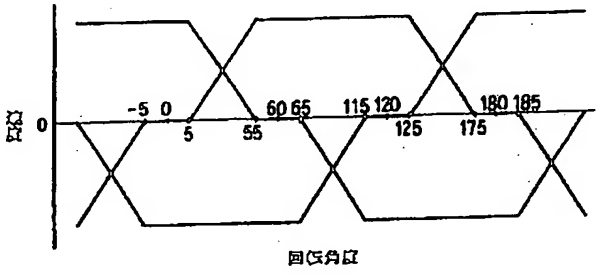
(74)代理人　弁理士　江原　省吾　(外２名)

(54)【発明の名称】　多連式無脈動定量ポンプ

(57)【要約】

【目的】　各ポンプより吐出される流量の和が常に一定になるようにプランジャー等の速度が制御される多連式往復動ポンプ（プランジャー、ダイアフラム、ベローズ等）において、吸排弁の開閉の遅れを起こさないようにして脈動をなくす。

【構成】　各々のポンプが吸入行程より吐出行程に入る際および吐出行程より吸入工程に入る際にプランジャー等が一定の範囲で停止し、吐出もしくは吸入を全く行わない区間を設ける。



【特許請求の範囲】
【請求項１】　各ポンプより吐出される流量の和が常に一定になるようにプランジャー等の速度が制御される多連カ式往復動ポンプにおいて、各々のポンプが吸入行程より吐出行程に入る際、および吐出行程より吸入工程に入る際にプランジャー等が一定の範囲で停止し、吐出もしくは吸入を全く行わない区間を持つことを特徴とする多連式無脈動定量ポンプ。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明は多連式無脈動定量ポンプに関する。
【０００２】
【従来の技術】各ポンプより吐出される流量の和が常に一定になるようにプランジャー等の速度が制御される多連式往復動ポンプは知られている。速度曲線が図５に示されるようなものとなる３連式プランジャーポンプの場合を例にとって説明すると、このポンプの吐出口に締り弁を設けて強制的に圧力を立てるようにし、締り弁と吐出口との間に圧力計を設けてその変化をチャート紙に記録すると図６のようになる。すなわち、ポンプ１回転で６回の脈動が発生する。これをカムの回転角度に対照すると図７のようになる。３連のプランジャーをＡ、Ｂ、Ｃとすると、
【０００３】

プランジャー	吐出開始	吐出終了
Ａ	０°	１８０°
Ｂ	１２０°	３００°
Ｃ	２４０°	６０°

となる。つまり、各プランジャーの吐出開始時および吸入開始時に脈動が発生する。これは、吸排弁の開閉するタイミングがプランジャーの動きに比べて遅れるために生じる。これを図８に従って詳しく述べると次のとおりである。
【０００４】①図８(a)は吐出時の弁の状態を示しており、吐出弁（Vd）が開き、吸入弁（Vi）が閉じている。②図８(b)は吐出終了時の弁の状態を示しており、吐出弁（Vd）は若干開き、吸入弁（Vi）は閉じている。③吸入開始時の状態は図８(c)に示されており、吐出弁（Vd）は完全には閉じておらず、吸入弁（Vi）も若干開いている。④吸入時の状態は図８(d)に示されており、吐出弁（Vd）は閉じ、吸入弁（Vi）は開いている。⑤吸入終了時の状態は図８(e)に示されており、吐出弁（Vd）は閉じ、吸入弁（Vi）は若干開いている。⑥吐出開始時の状態は図８(f)に示されており、吐出弁（Vd）は若干開き、吸入弁（Vi）も完全には閉じていない。
【０００５】以上の行程①～⑥で脈動の原因となるのは③および⑥の状態である。つまり、③の行程（図８(c)）では吸入開始時にもかかわらず吐出弁（Vd）が完全に閉まり切っていないため、吐出弁（Vd）の外側から逆流が起こり、ポンプ全体の流量が瞬間的に落ち、圧力が下がる。また、⑥の行程（図８(f)）ではポンプ内の液体が瞬間的に吸入弁（Vi）の外側へ押し出され、これもまた全体の流量が落ちてしまう。
【０００６】
【発明が解決しようとする課題】従来、こうした脈動の発生を完全に理解していなかったため、さまざまな工夫をしたものの完全に脈動を解消することはできなかったのである。
【０００７】そこで、この発明の目的は脈動をなくすことにあり、そのためには弁の開閉の遅れを起こさないようにすることが課題となる。
【０００８】
【課題を解決するための手段】この発明は、各ポンプより吐出される流量の和が常に一定になるようにプランジャー等の速度が制御される多連式往復動ポンプにおいて、各々のポンプが吸入行程より吐出行程に入る際および吐出行程より吸入工程に入る際にプランジャー等が一定の範囲で停止し、吐出もしくは吸入を全く行わない区間を持つことを特徴とする。
【０００９】
【作用】この発明により弁の開閉の遅れを起こさないようにするメカニズムは、上記③および⑥の行程時にプランジャーを完全にある一定期間静止させるものである。②から③への行程を考察した場合、②状態でプランジャーが上死点で静止した場合、吸入弁が閉じているため全体の流量が下がることはない。また、ポンプ内と吐出弁の外側とでは同圧力のため、弁球の自重で自然落下する。このため、プランジャーが静止中に、吸排弁がともに完全に閉じている状態になる。次に③の状態に入った際も吐出弁は完全に閉まっているため、液が逆流することなく吸入行程（④）に入る。
【００１０】次に⑤から⑥への行程を考察した場合、⑤の状態でプランジャーを下死点で静止させると、ポンプ内の流速も零となり、吸入弁の弁球が自重で自然落下し吸排弁がともに完全に閉じている状態になる。⑤の場合、吐出弁が閉じた状態であるので、ポンプの総吐出量に対して影響を与えることはない。次に⑥の状態に入った時、吸入弁は完全に閉じているのであるから、ポンプ内の液体はすべて吐出弁の外へ押し出される。すなわち、⑤（図７(e)）から⑥（図７(f)）を経ず図７(g)の状態になる。
【００１１】
【実施例】上に述べたような動きをするプランジャーの速度曲線の一例を示すと図１のようになる。これはカム駆動の場合でカムの回転角において１０° の間プランジャーが静止する例であるが、理論上は弁球が完全に閉じる時間があれば何度の間でもよい。また、弁球の閉じる速度を上げるため、スプリングで弁球を押してもよい。プランジャーが動いている速度曲線もいかなる形であれ

合成したものが常に一定であればよいのである。また、連数も２以上でいくらでもよい。しかし、実際製造するとなると、経済効率を考えると５連式くらいが限度である。また、性能を考えると２連式では吐出行程より吸入行程が短くなり、そのため吸入不足が起こりやすく、また、吸入行程が断続するため流量計を吸入側に付けられない等の問題が出る。したがって、最もよいのが３連式である。

【００１２】この発明は往復動方式であれば上述のプランジャーポンプに限らず、ダイアフラムポンプやベローズポンプ、ピストンポンプ等でも実施することができる。また、ポンプのカム駆動の形態は通常１プランジャーに対して１カム（平カム）が標準であるが（図２(a)）、３プランジャーを放射状に配置して１カムで駆動したり（図２(b)）、斜板にカムを加工してアキシャルタイプ（図２(c)）にすることもできる。

【００１３】図３にアキシャルタイプに適用した場合の具体的構成を例示する。図３に示すように、ハウジング（１）に３本のプランジャー（２）が所定の位相で、かつ、軸方向に摺動可能に収容されている。各プランジャー（２）は、図の右向きの吐出ストローク時に先端が加圧室（３）内に進入する小径部（2a）と、後端に鋼球（４）を担持した大径部（2b）とからなり、それぞれ軸受（５、６）で支持されている。プランジャー（２）に担持された鋼球（４）は、回転軸（７）に固定されたカム板（８）のカム溝（8a）に係合している。図面には示されていないが、スプリングや油圧等を利用した通常の戻し機構によって鋼球（４）とカム溝（8a）の係合関係が保たれる。また、カム板（８）の外径と側面はハウジング（１）に固定された軸受（９、10）で案内される。なお、軸受（９）は省略してもよい。カム溝（7a）は、図４(a)、(b)に示されるように、所定の回転角（θ）に対する深さ（ｓ）が、プランジャー（２）が図１に示されるような速度曲線を描くように設定されている。回転軸（７）は軸受（11、12）を介してハウジング（１）に支持され、ハウジング（１）外に突出した軸端にて電動機等の駆動手段と連結されるようになっている。加圧室（３）には通常の吸入弁（Vi）および吐出弁（Vd）が取り付けてあり、図示例の場合、３つの加圧室（３）への吸入および３つの加圧室（３）からの吐出を統合するための通路が外部配管を用いることなくハウジング（１）内部に形成されている。

【００１４】この実施例は、たとえば同一軸に所定の位相で３つのカム板を取り付けて並列配置した３つのプランジャーを駆動する構造に比べて構造がコンパクトになり、しかも組立や調整が簡単になるという利点がある。

【００１５】

【発明の効果】以上説明したように、この発明のカム式無脈動定量ポンプは、各々のポンプが吸入行程より吐出行程に入る際および吐出行程より吸入工程に入る際にプランジャー等が一定の範囲で停止し、吐出もしくは吸入を全く行わない区間を持つものであるから、弁の開閉の遅れを防止して脈動をなくすことができる。

【図面の簡単な説明】

【図１】本発明の作用を説明するための速度線図

【図２】カム駆動の諸形態を示す略図

【図３】本発明の実施例を示すアキシャル無脈動ポンプの縦断面図

【図４】図３に示されるカム板の側面図（(a)）および正面図（(b)）

【図５】従来技術を説明するための速度線図

【図６】回転角に対する圧力の変化を示すグラフ

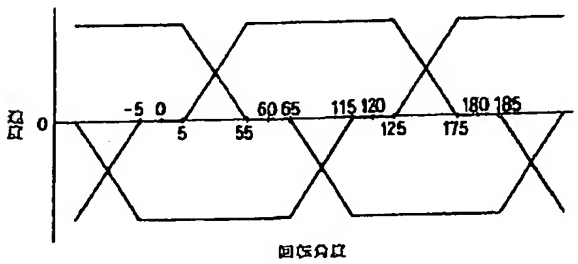
【図７】回転角に対する圧力の変化を示すグラフ

【図８】各行程のプランジャポンプの略図

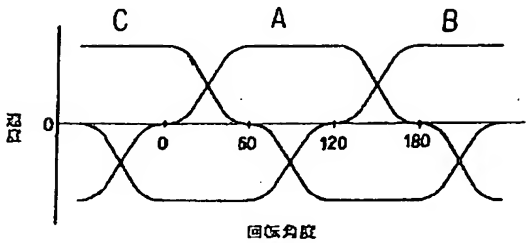
【符号の説明】

１　ハウジング
２　プランジャー
３　加圧室
４　鋼球
７　回転軸
８　カム板
8a　カム溝
Vi　吸入弁
Vd　吐出弁

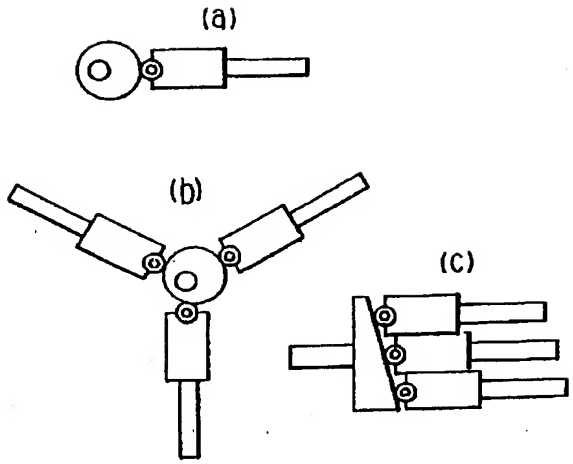
【図１】



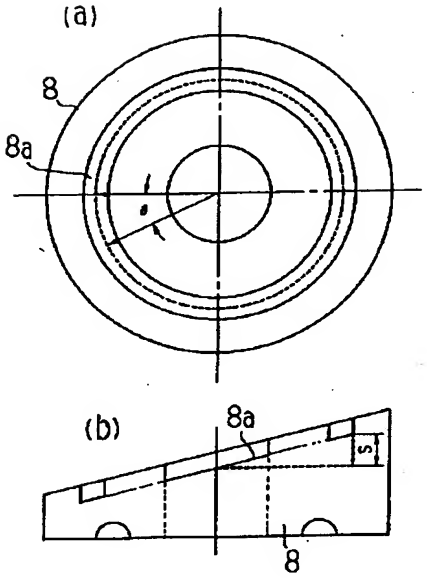
【図５】



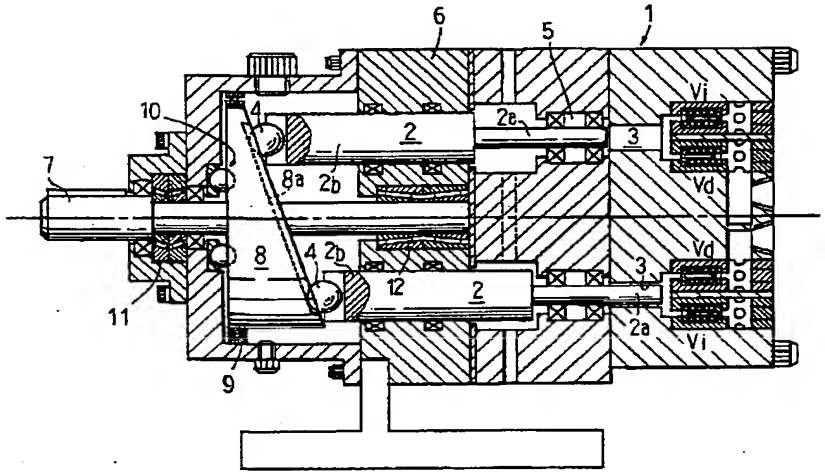
【図２】


(a)
(b)
(c)

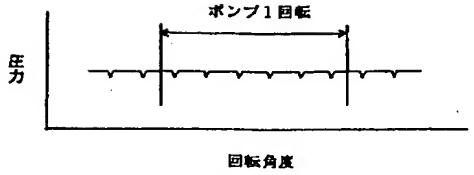
【図４】


(a)
8
8a
(b)
8a
S
8

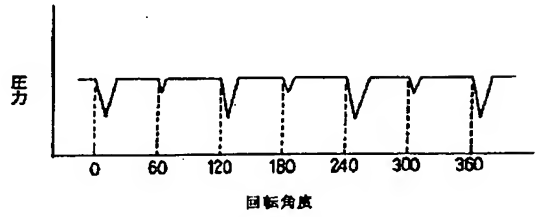
【図３】


6
5
1
10
4
2
2a
3
Vi
7
8a
2b
Vd
8
4
2b
12
2
3
Vd
11
2a
Vi
9

【図６】


ポンプ１回転
圧力
回転角度

【図７】


圧力
0
60
120
180
240
300
360
回転角度

【図８】